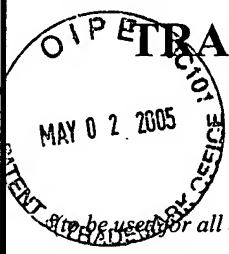



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 <p><b>TRANSMITTAL FORM</b></p> <p><i>(to be used for all correspondence after initial filing)</i></p>		<b>Application Number</b>	10/003,358
		<b>Filing Date</b>	11/14/2001
		<b>First Named Inventor</b>	Fang-Cheng Chang
		<b>Art Unit</b>	2825
		<b>Examiner Name</b>	Sun J. Lin
<b>Total Number of Pages in This Submission</b>	30	<b>Attorney Docket Number</b>	NTI-022

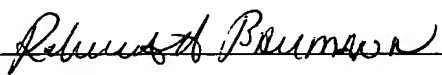
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<input checked="" type="checkbox"/> Fee Transmittal Form <input type="checkbox"/> Fee Attached <input type="checkbox"/> Amendment / Reply <input type="checkbox"/> After Final <input type="checkbox"/> Affidavits/declaration(s) <input type="checkbox"/> Extension of Time Request <input type="checkbox"/> Express Abandonment Request <input type="checkbox"/> Information Disclosure Statement <input type="checkbox"/> Certified Copy of Priority Document(s) <input type="checkbox"/> Reply to Missing Parts/Incomplete Application <input type="checkbox"/> Reply to Missing Parts under 37 CFR 1.52 or 1.53	<input type="checkbox"/> Drawing(s) <input type="checkbox"/> Terminal Disclaimer <input type="checkbox"/> Petition <input type="checkbox"/> Petition to Convert to a Provisional Application <input type="checkbox"/> Power of Attorney, Revocation Change of Correspondence Address <input type="checkbox"/> Statement Under 37 CFR 3.73(b) <input type="checkbox"/> CD, Number of CD(s) _____ <input type="checkbox"/> Request for Refund	<input type="checkbox"/> After Allowance Communication to TC <input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences <input checked="" type="checkbox"/> Appeal Communication to TC ( <i>Appeal Notice, Brief, Reply Brief</i> ) <input type="checkbox"/> Proprietary Information <input type="checkbox"/> Status Letter <input checked="" type="checkbox"/> Other Enclosure(s) ( <i>please identify below</i> ): Return Receipt Postcard
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<b>Firm Name</b>	BEVER, HOFFMAN & HARMS, LLP	<b>Customer Number</b>	29477
<b>Signature</b>			
<b>Printed Name</b>	Jeanette S. Harms		
<b>Date</b>	April 26, 2005	<b>Reg. No.</b>	35,537

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<b>FEE TRANSMITTAL</b> <b>For FY 2005</b>		Application Number	10/003,358
		Filing Date	11/14/2001
		First Named Inventor	Fang-Cheng Chang
		Examiner Name	Sun J. Lin
		Art Unit	2825
<input type="checkbox"/> Applicant claims small entity status. See 37 C.F.R. § 1.27		Attorney Docket No	NTI-022
<b>TOTAL AMOUNT OF PAYMENT (\$)</b> 500.00			

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**FEE CALCULATION**

**1. BASIC FILING, SEARCH, AND EXAMINATION FEES**

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Fees Paid (\$)
	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	
Utility	300	150	500	250	200	100	\$
Design	200	100	100	50	130	65	\$
Plant	200	100	300	150	160	80	\$
Reissue	300	150	500	250	600	300	\$
Provisional	200	100	0	0	0	100	\$

**2. EXCESS CLAIM FEES**

**Fee Description**

	Fee (\$)	Small Entity Fee (\$)
Each claim over 20 or, for Reissues, each claim over 20 and more than in the original patent	50	25
Each independent claim over 3 or, for Reissues, each independent claim more than in the original patent	200	100
Multiple dependent claims	360	180

Total Claims     Extra Claims     Fee (\$)     Fee Paid (\$)     Multiple Dependent Claims     Fee (\$)     Fee (\$)  
 - 20 or HP =     x     =    

HP = highest number of total claims paid for, if great than 20

Indep. Claims     Extra Claims     Fee (\$)     Fee Paid (\$)  
 - 3 or HP =     x     =    

HP = highest number of total claims paid for, if great than 3

**3. APPLICATION SIZE FEE**

If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 USC 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets     Extra Sheets     Number of each additional 50 or fraction thereof     Fee (\$)     Fee Paid (\$)  
 - 100 =     5- = (round up to a whole number) x     =    

**4. OTHER FEE(S)**

Non-English Specification - \$130 fee (no small entity discount)

Other: **APPEAL BRIEF**     **\$500.00**

**SUBMITTED BY**

Signature: \_\_\_\_\_ Registration No. 35,537 Telephone: (408) 451-5907  
 Name (Print/Type) Jeanette S. Harms Date: April 26, 2005



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Fang-Cheng Chang

Assignee: Synopsys, Inc.

Title: SIMULATION USING DESIGN GEOMETRY INFORMATION

Serial No.: 10/003,358 File Date: November 14, 2001

Examiner: Sun J. Lin Art Unit: 2825

Docket No.: NTI-022 (749)

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April 26, 2005

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APPEAL BRIEF

This Appeal Brief, filed in triplicate, is in support of the  
Notice of Appeal dated April 18, 2005.

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### I. REAL PARTY IN INTEREST

The real party in interest is the assignee, Synopsys, Inc., pursuant to the Assignments recorded in the U.S. Patent and Trademark Office on February 4, 2005 on Reel 015633, Frame 0738 and on November 14, 2001 on Reel 012355, Frame 0988.

### II. RELATED APPEALS AND INTERFERENCES

Based on information and belief, there are no other appeals or interferences that can directly affect or be directly affected by or have a bearing on the decision by the Board of Patent Appeals in the pending appeal.

### III. STATUS OF CLAIMS

Claims 1-27 are pending. Claims 1-27 stand rejected. In the present paper, rejected Claims 1-27 are appealed. Pending Claims 1-27 are listed in VIII. Claims Appendix.

### IV. STATUS OF AMENDMENTS

Claims 1, 6, and 11 were amended in this application after a first Office Action. No claims were amended after the Final Office Action dated February 23, 2005.

# V. SUMMARY OF CLAIMED SUBJECT MATTER

As described in the Specification, paragraph [0032]:

design geometry information outside the area of interest (AOI) on a mask can be combined with inspection information from the AOI to facilitate generating an accurate, simulated wafer image. The design geometry information can be easily generated or accessed, thereby ensuring an uninterrupted inspection process and minimizing the associated storage costs for the simulation process. As explained in further detail below, the design geometry information can be pseudo design geometry information or actual design geometry information.

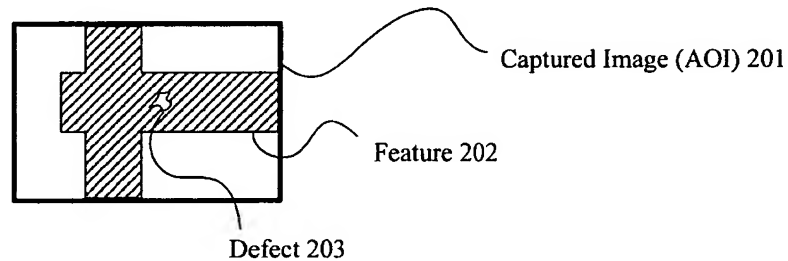


Figure 2A

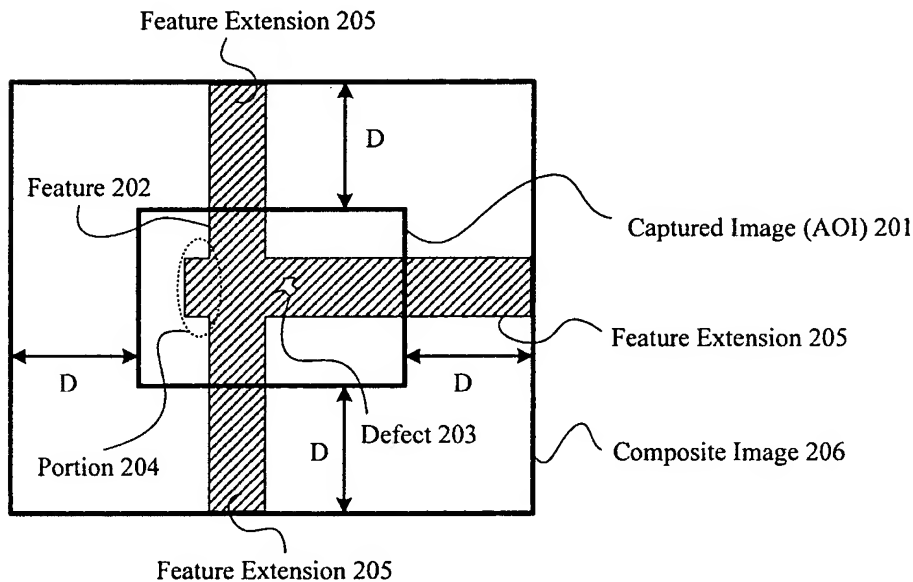


Figure 2B

As described in reference to Figures 2A and 2B (shown above), the Specification teaches:

[0034] In one embodiment, to provide a more accurate simulated wafer image of feature 202 and defect 203, pseudo design geometry information can be used. Specifically, any non-capped geometries that appear to end at the perimeter of an AOI can be extended to a predetermined distance. Thus, in Figure 2B, the three non-capped geometries of feature 202 can be extended a distance D to form feature extensions 205. Note that portion 204 of feature 202 is capped, e.g. is terminated within AOI 201, and therefore is not extended. AOI 201 and feature extensions 205 comprise a composite image 206.

[0035] Proximate features or portions of features outside the AOI can affect the printing of any feature and/or defect within the AOI. Thus, even pseudo features, i.e. feature extensions 205, that are inferred from the geometries of feature 202 can measurably improve the accuracy of the simulated wafer image of AOI 201. Advantageously, feature extensions 205 can be quickly generated and in turn can be incorporated into or used in conjunction with a simulation engine...

[0037] Providing design geometry information advantageously increases the area of valid information associated with the simulated wafer image of the AOI. For example, assuming an N:1 reduction ratio and AOI 201 (Figure 2A), the simulated wafer image of feature 202 would be  $1/N$  the size of feature 202. However, the amount of valid information associated with this simulated wafer image would be significantly less than  $1/N$  the area of AOI 201. In contrast, if both AOI 201 and feature extensions 205 (i.e. composite image 206 in Figure 2B) were used in the simulation, then the amount of valid information associated with the simulated wafer image of feature 202 can be increased to approximately  $1/N$  the area of AOI 201, i.e. approximately the same size as the simulated wafer image. Thus, the area of valid information associated with the AOI significantly increases with the inclusion of design geometry information in the simulation process. Note that the area of valid information

can also define a measurement for the "accuracy" or "quality" of the simulated wafer image.

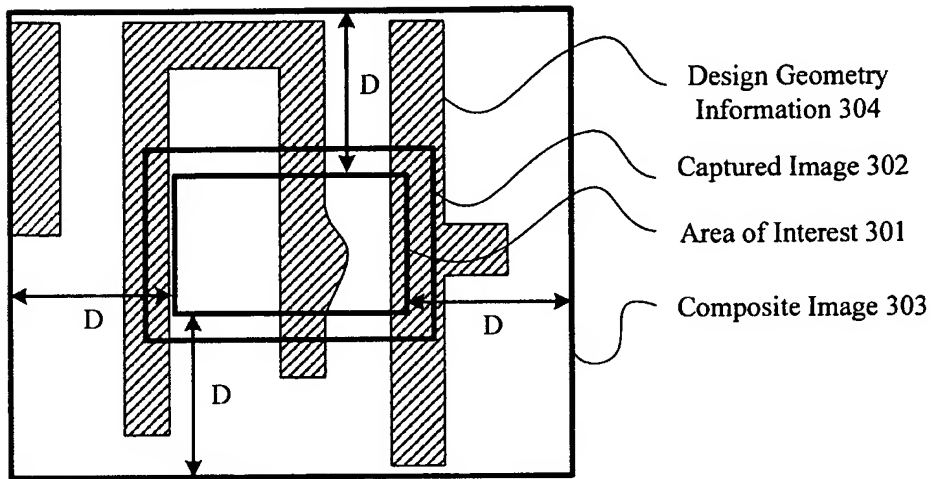


Figure 3A

As described in reference to Figure 3A (shown above), the Specification teaches:

[0040] Figure 3A illustrates an area of interest (AOI) 301 defined within a captured image 302. The perimeter of a composite image 303 is defined as a distance D from AOI 301. In one embodiment, AOI 301 comprises inspection information and the area outside of captured image 302 but within composite image 303 comprises actual design geometry information 304 (provided by, for example, a GDS-II file or a MEBES file with appropriate magnification and positioning adjustments). To decrease storage needs while substantially providing the same accuracy, the inspection information provided within captured image 302 and outside AOI 301 can be replaced with actual design geometry information from the same or a different file as actual design geometry information 304.

As described in reference to Figure 4 (shown below), the Specification teaches:

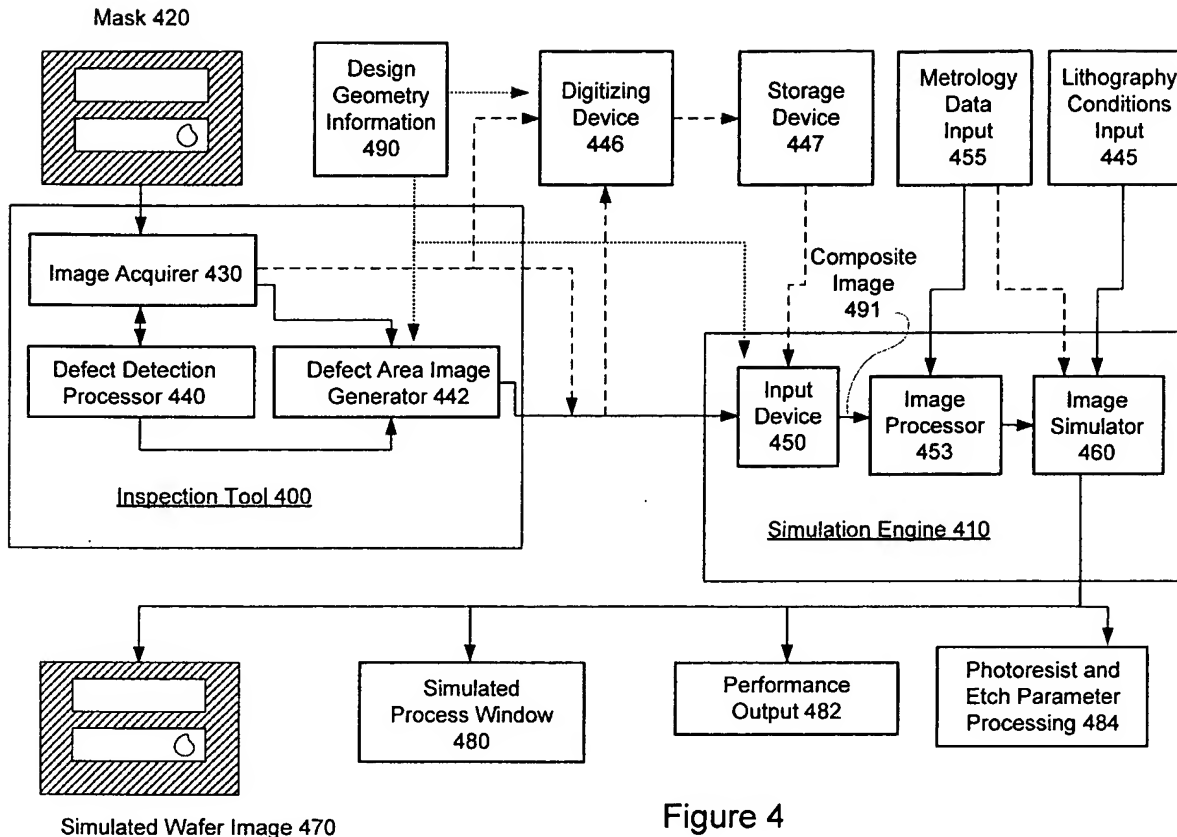


Figure 4

[0062] In one embodiment, mask 420 can be a trim mask used in an alternating PSM process. Advantageously, design geometry information 490 can include information regarding the corresponding mask that includes phase shifting regions. In this manner, simulation engine 410 can more accurately analyze the trim mask. Note that the phase shifting mask can also be analyzed as mask 420 and information regarding the corresponding trim mask can be provided as design geometry information 490. In this case, a defect in the area of interest on the alternating PSM can have one of two phases, which in the absence of additional information cannot be discerned. In one embodiment, two simulated results can be provided, i.e. one result assuming a first phase and another result assuming a second phase, thereby providing the user with the worse case scenario. Alternatively, based on the design geometry information 490, the user can be provided with the more probable result. This design geometry technique can be advantageously

used for any multiple exposure mask having any number of phases.

Referring to Claim 1, the inspection image of the area of interest (AOI) can include captured image 201 (Figure 2B) or captured image 302 (Figure 3A). The design geometry information regarding an area outside the AOI without use of inspection images can include feature extensions 205 (Figure 2B) or design geometry information 304 (Figure 3A). A simulation of the AOI based on the inspection image and the design geometry information can be performed using the system shown in Figure 4. See also, e.g. paragraphs [0032], [0034], [0035], [0038], and [0040].

Referring to Claim 3, the virtual image can include feature extensions 205 (Figure 2B). See also, e.g. paragraphs [0032], [0034], and [0035].

Referring to Claim 4, a combined image can include composite image 303 (Figure 3A) and receiving the combined images can be done by step 506 (Figure 5). See also, e.g. paragraphs [0040], [0068], and [0069].

Referring to Claim 5, the virtual image can include feature extensions 205 (Figure 2B) and receiving the inspection image and the virtual image can be done by step 506 (Figure 5). See also, e.g. paragraphs [0032], [0040], [0068], and [0069].

Referring to Claim 6, combining the inspection image and the virtual image can be done by step 506 (Figure 5). See also, e.g. paragraphs [0032], [0040], [0068], and [0069].

Referring to Claim 8, extending the geometries is shown in Figure 2B. See also, e.g. paragraphs [0034], [0037], and [0038].

Referring to Claim 9, accessing information regarding another mask is described in paragraphs [0062], [0070], and [0071]. See also, e.g. Figures 4, 6B, and 6C.

Referring to Claim 10, accessing information regarding at least one of a trim mask and a phase shifting mask is described in paragraphs [0062], [0070], and [0071]. See also, e.g. Figures 4, 6B, and 6C.

Referring to Claim 11, the first information (relating to a first area) from an inspection tool can include captured image 201 (Figure 2B) or captured image 302 (Figure 3A). The second information (relating to an area outside the first area) from a design file can include feature extensions 205 (Figure 2B) or design geometry information 304 (Figure 3A). See also, e.g. paragraphs [0032], [0034], [0035], and [0040].

Referring to Claim 18, the means for identifying an AOI can include image acquirer 430 (Figure 4), the means for providing an inspection image of the AOI can include defect area image generator 442, the means for providing design geometry information regarding an area surrounding the AOI can include design geometry information 490, and the means for performing a simulation of the AOI based on the inspection image and the design geometry information can include simulation engine 410. See also, e.g. paragraphs [0047], [0048], [0050], [0051], [0052], [0053], and [0054].

Referring to Claim 20, the means for generating a virtual image of the area surrounding the AOI and combining the inspection image and the virtual image can include design geometry information 490, defect area image generator 442, input device 450 (Figure 4), step 508, step 509, or step 506 (Figure 5). See also, e.g. paragraphs [0015], [0051], [0054], [0055], [0068], and [0069].

Referring to Claim 21, the means for generating a virtual image of the area surrounding the AOI and the means for receiving the inspection image and the virtual image can include design geometry information 490, defect area image generator

442, input device 450 (Figure 4), step 508, step 509, or step 506 (Figure 5). See also, e.g. paragraphs [0015], [0051], [0054], [0055], [0068], and [0069].

Referring to Claim 23, the means for extending at least one geometry of a feature in the AOI to a predetermined distance can include design geometry information 490, step 508, or step 509. See also, e.g. paragraphs [0015], [0053], [0069].

Referring to Claim 24, the means for accessing database information regarding another mask can include design geometry information 490 (Figure 4), step 508, and step 509 (Figure 5). See also, e.g. paragraphs [0062] and [0069].

Referring to Claim 25, the feature can include a feature of simulated wafer image 470 (Figure 4), wherein the feature has an accuracy based on a mask inspection image (e.g. an image generated by defect area image generator 442) and design geometry information outside the defined area (e.g. design geometry information 490). See also, e.g. paragraphs [0009], [0017], [0035], and [0037].

Referring to Claim 26, generating the mask inspection image can be done by defect area image generator 442 (Figure 4) and combining the mask inspection image with the design geometry information outside the defined area to create a composite image can be done by inspection tool 400 (e.g. defect area image generator 442) or simulation engine 410 (e.g. input device 450). See also, e.g. paragraphs [0009], [0017], [0035], and [0037].

Referring to Claim 27, the first set of instruction can include those instructions performed by defect area image generator 442 (Figure 4). The second set of instruction can include those instructions performed by defect area image generator 442 or input device 450. The third set of instruction can include those instructions performed by image simulator 460. Note that Figure 5 also illustrates various processes for

simulating based on combining inspection information and design geometry information. These processes can be implemented using the sets of instructions recited in Claim 27. See also, e.g. paragraphs [0018], [0051], [0053], [0054], and [0056].

#### VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The following issues are presented to the Board of Appeals for decision:

(A) Whether Claims 1-27 are patentable under 35 U.S.C. 103(a) over U.S. Patent 6,272,236 (Pierrat) in view of U.S. Patent 6,057,063 (Liebmann).

#### VII. ARGUMENTS

A. Claims 1-27 are patentable under 35 U.S.C. 103(a) over U.S. Patent 6,272,236 (Pierrat) in view of U.S. Patent 6,057,063 (Liebmann).

##### 1. Pierrat: Overview

Pierrat teaches inspecting defect printability instead of inspecting defects in the chrome. Col. 3, lines 34-35. Because the printing of defects is amplified by resist processing, accounting time for resist effects in the inspection process reduces the number of costly defects occurring during resist processing. Col. 3, lines 35-38. In one embodiment, a first simulation of resist formed according to original pattern data can be created. Col. 3, lines 46-48. After capturing an inspection image of the corresponding portion of the mask, a second simulation of resist formed according to that inspection image can be created. Col. 3, lines 48-50. At this point, the

first and second simulations can be compared. Col. 3, lines 50-51.

## 2. Liebmann: Overview

Liebmann teaches designing regions to be phase shifted and assigning phases to the regions, thereby generating phase shift mask designs from full-scale chip layouts. Col. 3, lines 48-52.

## 3. Claims 1-27 are patentable over Pierrat and Liebmann

Claim 1 recites:

generating an inspection image of the AOI;  
providing design geometry information  
regarding an area outside the AOI without use of  
inspection images of that area; and  
performing a simulation of the AOI based on  
the inspection image and the design geometry  
information.

As taught by Applicant in paragraph [0032], design geometry information outside the area of interest (AOI) on a mask can be combined with inspection information from the AOI to facilitate generating an accurate, simulated wafer image. The design geometry information can be easily generated or accessed, thereby ensuring an uninterrupted inspection process and minimizing the associated storage costs for the simulation process. The design geometry information can be pseudo design geometry information or actual design geometry information. In contrast, neither Pierrat nor Liebmann disclose or suggest this improved simulation technique or appreciate its advantages.

Pierrat teaches providing an inspection device for capturing image data of a pattern in the mask, circuitry for using the captured image data to create an image of resist formed according to the pattern, circuitry for using the pattern data used to form the mask pattern to create a second image of resist formed, and circuitry for comparing the first image to

the second image. Col. 3, line 64 to col. 4, line 4. Specifically, the image acquisition process generates a first simulated image. Col. 5, lines 28-29. Similarly, image data derived from the original pattern data can be processed through image simulation circuitry to create a second simulated image. Col. 5, lines 48-50. These first and second simulated images can be forwarded to and then compared by defect detection circuitry. Col. 6, lines 48-50.

Therefore, Pierrat fails to teach providing design geometry information regarding an area outside the AOI. Notably, for the defect detection circuitry to perform its comparison, the pattern data must logically refer to the AOI, not to the area outside the AOI. Therefore, Pierrat would teach away from this limitation.

Moreover, Pierrat fails to teach performing a simulation of the AOI based on the inspection image and the design geometry information. Instead, Pierrat teaches performing two separate simulations: one simulation based on inspection data and another simulation based on design data. To obtain the inspection data, mask pattern 160.2 is exposed to energy source 110 and projected into image sensor 130. Col. 5, lines 8-9. The mask image is then acquired using inspection machine 100. Col. 5, lines 9-10. The resulting digital image of 160.2 is sent to image simulation circuitry, where it is used to construct image simulation 180. Col. 5, lines 45-48. Pierrat teaches nothing regarding supplementing this inspection data with design data to improve simulation accuracy.

The Office Action states that a "phase shift mask associated with the AOI is constructed based on design geometry information regarding an area outside the AOI without use of inspection images of that area". Notably, Claim 1 does not

refer to constructing of a mask, but instead to simulating an area of interest of an already constructed mask.

Moreover, the Office Action states that by combining the teachings of Liebmann and Pierrat, the following subject matter is disclosed utilizing Fig. 1 of Pierrat:

Simulation of a critical feature in the AOI is performed based on the inspection image of the AOI and the phase regions of a phase shifting mask deployed around the AOI according to design geometry information (photomask) in Step 180 - {Fig. 1}.

Applicant notes that a photomask is not design geometry information. Applicant further notes that element 180 is a simulated image, not a step. Applicant further notes that because neither reference discloses or suggests using phase regions deployed around the AOI in a simulation, this analysis reflects hindsight, which is impermissible.

Liebmann teaches a process for converting a chip design to a phase-shifted mask layout. Col. 3, lines 41-43. In this process, Liebmann locates features in a design of a phase-shifted mask that require phase shifting, creates uncolored phase regions on opposite sides of the features by expanding the feature edges, provides phase termination of the phase regions based upon space constraints of the PSM technique utilized, determines phases of the phase regions, determines whether coloring errors and un-phase-shiftable design features exist, applies mask process specific overlaps and expansions to prepare designed data levels for mask manufacture, and derives a residual phase edge image removal design. Col. 12, lines 39-54. Thus, Liebmann teaches how to create a phase shifting mask. Therefore, Liebmann teaches nothing regarding simulation, much less improving simulation results based on a physical mask.

In fact, Applicant respectfully submits that no suggestion exists to combine Pierrat and Liebmann. Pierrat teaches an improved technique for inspecting a mask, whereas Liebmann teaches a process for determining phases in a design for a phase shifting mask. The Office Action fails to indicate any passage in Pierrat or Liebmann that would suggest using a phase determination technique in a mask inspection technique. Therefore, Applicant submits that Pierrat and Liebmann are improperly combined.

Because Pierrat and Liebmann, assuming arguendo that these references can be combined, fail to disclose or suggest performing a simulation of the AOI based on the inspection image and the design geometry information (wherein the design geometry information is regarding an area outside the AOI, provided without use of inspection images of that area), Applicant submits that Claim 1 is patentable.

Claims 2-10 depend from Claim 1 and therefore are patentable for at least the reasons provided for Claim 1.

Moreover, Claim 3 recites, "wherein modifying data includes generating a virtual image of the area outside the AOI and combining the inspection image and the virtual image". The Office Action states that modifying data includes generating phase regions of a phase shifting mask outside and around the AOI and combining the inspecting image of critical feature and the phase regions of the phase shifting mask. Applicants are confused. Why would phase regions need to be generated for an already existing phase shifting mask? The Office Action further characterizes a phase shifting image, which is defined as an image generated by the phase regions of a phase shifting mask, as a virtual image. Applicants traverse this characterization. Specifically, an image generated from exposing a mask would be an inspection image, not a virtual image (which is based on

data). Because Pierrat and Liebmann fail to disclose or suggest the recited virtual image, Applicant submits that Claim 3 is further patentable over these references.

Moreover, Claim 4 recites, "wherein performing the simulation includes receiving the combined images". The Office Action states that "the simulation 180 is performed on the combined images 160.2, which is a combination of the inspecting image and the image of phase regions of phase shifting mask received from Step 130 [Fig. 1]." Applicants traverse this characterization. As taught by Pierrat, mask pattern 160.2 is exposed to energy source 110 and is projected onto image sensor 130. Col. 5, lines 8-9. The resulting digitized image of 160.2 is sent to image simulation circuitry, where it is used to construct image simulation 180. Col. 5, lines 45-48. Because neither Pierrat nor Liebmann disclose or suggest receiving combined images for simulation, Applicant submits that Claim 4 is further patentable over these references.

Moreover, Claim 5 recites, "wherein modifying data includes generating a virtual image of the area outside the AOI and performing the simulation includes receiving the inspection image and the virtual image". Therefore, Claim 5 is further patentable over Pierrat and Liebmann for substantially the same reasons provided for Claims 3 and 4.

Moreover, Claim 6 recites, "wherein performing the wafer simulation further includes combining the inspection image and the virtual image". Therefore, Claim 6 is further patentable over Pierrat and Liebmann for substantially the same reasons provided for Claims 3 and 4.

Moreover, Claim 8 recites, "wherein providing design geometry information includes extending geometries of a feature in the AOI". The Office Action states "the design geometry information is utilized in formation of phase shifting mask for

a (critical) feature in an AOI. Therefore the design geometry information includes extending geometries of the (critical) feature in the AOI." Applicants traverse this analysis. Creating a phase shifting mask is separate from performing a simulation of an already created phase shifting mask. Nor is it clear, absent hindsight, how design geometry information can include extending geometries. Because Pierrat and Liebmann fail to disclose or suggest extending geometries, Applicants submit that Claim 8 is further patentable over these references.

Moreover, Claim 9 recites "wherein providing design geometry information includes accessing information regarding another mask". The Office Action cites Figs. 1-5 of Liebmann as teaching this limitation. These figures of Liebmann teach one mask design only. Because neither Pierrat nor Liebmann disclose or suggest accessing information regarding another mask, Applicant submits that Claim 9 is further patentable over those references.

Moreover, Claim 10 recites "wherein providing design geometry information includes accessing information regarding at least one of a trim mask and a phase shifting mask". The Office Action cites Figs. 1-5 of Liebmann as teaching this limitation. These figures of Liebmann teach one mask design only. Because neither Pierrat nor Liebmann disclose or suggest accessing information regarding another mask, Applicant submits that Claim 10 is further patentable over those references.

Claim 11, as amended, recites:

Data for a simulation engine, the data comprising:

first information from an inspection tool,  
the first information relating to a first area;  
and

second information from a design file, the second information relating to a second area outside the first area,

wherein the first information and the second information provide enhanced simulation accuracy for the first area.

Therefore, Claim 11 is patentable for substantially the same reasons presented for Claim 1.

The Office Action states that the first information is the inspection image taught by Pierrat and the second information is obtained from design geometry information (i.e. design file for phase shifting mask). Specifically, the Office Action states that the second information is related to an area of a phase region (i.e. the second area) of the phase shifting mask outside the first area. The Office Action further states that "the first information (inspection image of AOI) and the second information (phase shifting mask) provide enhanced simulation accuracy of the first area (AOI)".

Applicant respectfully submits that this characterization of the second information reflects hindsight. Liebmann teaches determining phases for a phase shifting design, which, depending on the proximity of the features, could include the whole design or only individual features. Pierrat teaches using inspection information only from the first area. Absent hindsight, it would not be obvious for Pierrat to use the second information, which relates to a second area outside the first area.

Because neither Pierrat nor Liebmann disclose or suggest the second information as data for a simulation engine, Applicant submits that Claim 11 is patentable.

Claims 12-17 depend from Claim 11 and therefore are patentable for at least the reasons provided for Claim 11.

Claim 18 recites:

A system for simulating a defect on a mask,  
the system comprising:

means for identifying an area of interest (AOI) including the defect;  
means for providing an inspection image of the AOI;  
means for providing design geometry information regarding an area surrounding the AOI; and  
means for performing a simulation of the AOI based on the inspection image and the design geometry information.

Therefore, Claim 18 is patentable for substantially the same reasons presented for Claim 1.

Claims 19-24 depend from Claim 18 and therefore are patentable for at least the reasons provided for Claim 18.

Moreover, Claim 20 recites, "wherein the means for modifying data includes means for generating a virtual image of the area surrounding the AOI and combining the inspection image and the virtual image". Therefore, Claim 20 is further patentable over the cited references for substantially the same reasons presented for Claim 3.

Moreover, Claim 21 recites, "wherein the means for modifying data includes means for generating a virtual image of the area surrounding the AOI and the means for performing the simulation includes means for receiving the inspection image and the virtual image". Therefore, Claim 21 is further patentable over the cited references for substantially the same reasons presented for Claim 5.

Moreover, Claim 23 recites, "wherein the means for providing design geometry information includes means for extending at least one geometry of a feature in the AOI to a predetermined distance". Therefore, Claim 23 is further patentable over the cited references for substantially the same reasons presented for Claim 8.

Moreover, Claim 24 recites "wherein the means for providing design geometry information includes means for accessing

information regarding another mask". Therefore, Claim 24 is further patentable over the cited references for substantially the same reasons presented for Claim 9.

Claim 25 recites:

A simulated image of an area of interest on a wafer, the simulated image comprising:  
a feature, wherein the feature has an accuracy based on a mask inspection image having a defined area and design geometry information outside the defined area.

Notably, the Office Action fails to indicate any passage in either Pierrat or Liebmann that teaches the recited accuracy. Therefore, Applicant submits that Claim 25 is patentable over the cited references.

Claim 26 recites:

A method of improving simulation accuracy for an area of interest on a mask, the method comprising:  
generating a mask inspection image having a defined area, wherein simulating the mask inspection image provides a first accuracy; and  
combining the mask inspection image with design geometry information outside the defined area to create a composite image, wherein simulating the composite image provides an improved accuracy compared to the first accuracy.

The Office Action appears to state that image simulation 185 of Pierrat provides a first accuracy whereas image simulation 180, which could include phase shifting effects, provides an improved accuracy. Applicants traverse this characterization. Specifically, if image simulation 180 includes phase shifting effects (i.e. if pattern 160.2 includes phase shifting), then Pierrat would use a pattern database 150 including phase shifters to ensure that defect detection 140 could make a meaningful decision. That is, in Fig. 1, Pierrat compares simulation results of a mask design with simulation

results of an actual mask implementing that mask design (in Fig. 2, Pierrat compares simulations of two acquired images from two die on the same mask). Having two different accuracies for simulations 180 and 185 would render their comparison meaningless.

Because Pierrat and Liebmann fail to disclose or suggest combining the mask inspection image with design geometry information outside the defined area to create a composite image, wherein simulating the composite image provides an improved accuracy compared to the first accuracy, Applicant submits that Claim 26 is patentable over those cited references.

Claim 27 recites:

A computer program product for simulating an area of interest (AOI) on a mask, the computer program product comprising:

a first set of instructions for receiving inspection information regarding the AOI;

a second set of instructions for receiving design geometry information regarding an area outside the AOI; and

a third set of instructions for performing a simulation of the AOI based on the inspection information and the design geometry information.

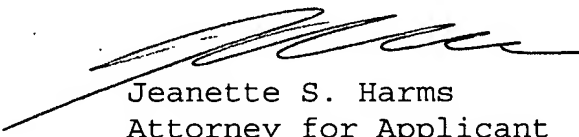
Therefore, Claim 27 is patentable over the cited references for substantially the same reasons presented for Claim 1.

**B. CONCLUSION**

For the foregoing reasons, it is submitted that the Examiner's rejections of Claims 1-27 are erroneous, and reversal of these rejections is respectfully requested.

Respectfully submitted,

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I hereby certify that this correspondence is being deposited with the United States Postal Service as FIRST CLASS MAIL in an envelope addressed to: Mail Stop Appeal Brief-Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on April 26, 2005.

4/26/2005      Rebecca A. Baumann  
Date                      Signature: Rebecca A. Baumann

**VIII. CLAIMS APPENDIX**

1. (Previously Presented) A method of simulating an area of interest (AOI) on a mask, the method comprising:

identifying the AOI;  
generating an inspection image of the AOI;  
providing design geometry information regarding an area outside the AOI without use of inspection images of that area;  
and

performing a simulation of the AOI based on the inspection image and the design geometry information.

2. (Original) The method of Claim 1, wherein providing design geometry information includes modifying data representing an area surrounding the AOI.

3. (Original) The method of Claim 2, wherein modifying data includes generating a virtual image of the area outside the AOI and combining the inspection image and the virtual image.

4. (Original) The method of Claim 3, wherein performing the simulation includes receiving the combined images.

5. (Original) The method of Claim 2, wherein modifying data includes generating a virtual image of the area outside the AOI and performing the simulation includes receiving the inspection image and the virtual image.

6. (Previously Presented) The method of Claim 5, wherein performing the simulation further includes combining the inspection image and the virtual image.

7. (Original) The method of Claim 1, wherein providing design geometry information includes accessing at least one of a GDS-II file, a MEBES file, and a bit map.

8. (Original) The method of Claim 1, wherein providing design geometry information includes extending geometries of a feature in the AOI.

9. (Original) The method of Claim 1, wherein providing design geometry information includes accessing information regarding another mask.

10. (Original) The method of Claim 9, wherein providing design geometry information includes accessing information regarding at least one of a trim mask and a phase shifting mask.

11. (Previously Presented) Data for a simulation engine, the data comprising:

first information from an inspection tool, the first information relating to a first area; and  
second information from a design file, the second information relating to a second area outside the first area,  
wherein the first information and the second information provide enhanced simulation accuracy for the first area.

12. (Original) The data of Claim 11, wherein the design file includes at least one of a GDS-II file, a MEBES file, and a bit map.

13. (Original) The data of Claim 11, wherein the second area is defined by at least one predetermined distance from a perimeter of the first area.

14. (Original) The data of Claim 11, wherein the second area is defined by a plurality of distances from a perimeter of the first area.

15. (Original) The data of Claim 11, wherein the first area is user defined.

16. (Original) The data of Claim 11, wherein the first and second areas are system defined.

17. (Original) The data of Claim 11, wherein the first area relates to a first mask and the second area relates to a second mask associated with the first mask.

18. (Original) A system for simulating a defect on a mask, the system comprising:

- means for identifying an area of interest (AOI) including the defect;

- means for providing an inspection image of the AOI;

- means for providing design geometry information regarding an area surrounding the AOI; and

- means for performing a simulation of the AOI based on the inspection image and the design geometry information.

19. (Original) The system of Claim 18, wherein the means for providing design geometry information includes means for modifying data representing an area surrounding the AOI.

20. (Original) The system of Claim 19, wherein the means for modifying data includes means for generating a virtual image

of the area surrounding the AOI and combining the inspection image and the virtual image.

21. (Original) The system of Claim 19, wherein the means for modifying data includes means for generating a virtual image of the area surrounding the AOI and the means for performing the simulation includes means for receiving the inspection image and the virtual image.

22. (Original) The system of Claim 18, wherein the means for providing design geometry information includes at least one of a GDS-II file, a MEBES file, and a bit map.

23. (Original) The system of Claim 18, wherein the means for providing design geometry information includes means for extending at least one geometry of a feature in the AOI to a predetermined distance.

24. (Original) The system of Claim 18, wherein the means for providing design geometry information includes means for accessing database information regarding another mask.

25. (Original) A simulated image of an area of interest on a wafer, the simulated image comprising:

a feature, wherein the feature has an accuracy based on a mask inspection image having a defined area and design geometry information outside the defined area.

26. (Original) A method of improving simulation accuracy for an area of interest on a mask, the method comprising:

generating a mask inspection image having a defined area, wherein simulating the mask inspection image provides a first accuracy; and

combining the mask inspection image with design geometry information outside the defined area to create a composite image, wherein simulating the composite image provides an improved accuracy compared to the first accuracy.

27. (Original) A computer program product for simulating an area of interest (AOI) on a mask, the computer program product comprising:

a first set of instructions for receiving inspection information regarding the AOI;

a second set of instructions for receiving design geometry information regarding an area outside the AOI; and

a third set of instructions for performing a simulation of the AOI based on the inspection information and the design geometry information.

IX. EVIDENCE APPENDIX

X. RELATED PROCEEDINGS APPENDIX